ARMED FORCES RADIOBIOLOGY RESEARCH INSTITUTE
DEFENSE ATOMIC SUPPORT AGENCY
BETHESDA, MARYLAND 20014

Thursday, 5 December 1968

AGENDA

18th MEETING OF THE BOARD OF GOVERNORS

0845-0900	Welcome - Coffee	Directorate
0900-0910	Meeting Opened	VADM Mustin
	Introduction - Agenda	COL Mitchell
	Minutes	CAPT Stark
0910-1025	AFRRI Development and Progress Report COL Mitchell, COL Browning, CDR Varon	
1025-1045	Coffee Break	
1045-1130	Research Activities Report	
	a. Incapacitation in the Minature Pig After Exposure to Pulsed Mixed Gamma-Neutron Radiations	LT Chaput
	b. Partial Body Shielding to Prevent Incapacitation in Irradiated Monkeys and Beagles	LT Thorp
1130-1135	Summary of Recent DASA Biomedical Research Coordination Meetings	CAPT Stark
1135	Discussion and Closing Remarks	VADM Mustin

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SUBJECT: Minutes of the Eighteenth Meeting, Armed Forces Radiobiology Research Institute Board of Governors, 5 December 1968

1. Attendees:

Defense Atomic Support Agency
VADM L. M. Mustin, Director
Captain J. E. Stark, Surgeon
Mr. P. H. Haas, Assistant to Deputy (EXP RES)
Colonel P. J. Donohoe, Executive Officer
Colonel J. A. Hilcken, Medical Directorate
Lt. Colonel W. R. Godden, Medical Directorate

Service Representatives
Army
Colonel W. Dunnington, Director of Professional Services, SG
Colonel J. B. Young, Chief, Nuclear Biological and Chemical Sciences Division, SG

Navy
RADM F. B. Voris, Assistant Chief for Research and Military Medical Specialities, BUMED
Captain B. K. Hastings, Director for Submarine and Radiation Medicine Division, BUMED
Captain C. L. Waite, Commanding Officer, Naval Medical School, NNMC
Commander Charles F. Tedford, Radiation Safety Branch, Submarine and Radiation Medicine Division, BUMED

Air Force
Lieutenant General K. E. Pletcher, The Surgeon General, USAF
Colonel R. S. Malone, Staff Assistant for Medical Research, OTSG
Lt. Colonel Dale R. Lindall, Bionucleonics, Special Weapons Defense, OTSG

Atomic Energy Commission
Dr. John R. Totter, Director, Division of Biology and Medicine
Dr. H. B. Bruner, Assistant Director for Medical and Health Research, Division of Biology and Medicine

AFRRI
Colonel Hugh B. Mitchell, Director
Colonel L. E. Browning, Deputy Director, Operations
Commander Myron I. Varon, Assistant Deputy Director, Scientific
Mr. R. A. Moser, Special Staff Assistant
Colonel A. E. Adams, Chairman, Military Analysis Department
Lt. Colonel A. F. Green, Head, Logistics Department

Commander R. E. George, Chairman, Radiation Biology Department
Dr. S. J. Baum, Chairman, Experimental Pathology Department
Commander R. F. Reed, Military Analysis Department
Major John Kendig, Radiological and Industrial Safety Department
Mr. Robert Carter, Chairman, Physical Sciences Department
Dr. William F. Davis, Acting Chairman, Behavioral Sciences Department
Lieutenant R. L. Chaput, Radiation Biology Department
Lieutenant J. W. Thorp, Radiation Bidogy Department
LCDR A. F. Shedlosky, Head, Administration Department

2. The meeting was called to order by Admiral Mustin at 0900 hours in the Board Room of the AFRRI. The minutes of the 17th meeting of the Board of Governors were approved as previously distributed to the members of the Board.

3. The AFRRI Development and Progress Report was presented by Colonel Mitchell, Colonel Browning and Commander Varon. See Inclosure 1 for text.

4. Part I of the Research Activities Report was a presentation by Lt. R. L. Chaput entitled "Incapacitation in the Miniature Pig after Exposure to Pulsed Mixed Gamma-Neutron Radiations." The miniature pig was selected to study incapacitation in an animal of human proportions. The animals were trained by shock avoidance to traverse a shuttle box. Once trained to proficiencies of over 90%, the pigs were exposed to a pulse of mixed gamma-neutron radiations from a TRIGA at midair doses ranging from 4,000 to 20,000 rads. A film was shown with the following descriptive remarks: Definite periods of early but transient incapacitation (ETI) are observed in certain animals shortly after exposure to a supralethal dose of radiation. Recovery occurs and is followed by a period of relatively normal behavior which persists until the onset of permanent and complete incapacitation (PCI) shortly before death. Early transient incapacitation occurred immediately after irradiation and was observed for several minutes after doses as low as 2400 rads and for over 20 minutes at 7200 rads and above. The subsequent period of relatively normal behavior was usually preceded by a brief recovery phase and followed by a brief degenerative phase, during which performance decrement was observed. Permanent complete incapacitation then occurred shortly before death. At the higher doses, many animals never returned to normal baseline performances but simply experienced a period of performance decrement between ETI and PCI. At 12,000 rads, the pigs were permanently and completely incapacitated immediately after irradiation.

5. Part II of the Research Activities Report was presented by Lt. J. W. Thorp. This portion was entitled: "Partial Body Shielding to Prevent Incapacitation in Irradiated Monkeys and Beagles." His discussion was summarized as follows: Materials and methods for partial-body exposures under Work Unit R MD 1-9046 were presented. The results of animal exposures accomplished under this Work Unit were also described. Head shielding prolonged the survival and effectiveness of beagles which received supralethal (15,000 to 25,000 rad) doses of pulsed, mixed gamma-neutron radiations,

but trunk shielding was not beneficial. Two groups of chaired, trained monkeys received 4500 rads (midline tissue dose to the chest) of pulsed, mixed gamma-neutron radiations. The heads of one group were shielded. After irradiation, performance decrement occurred in both groups, but it was more severe and lasted much longer in animals that were unshielded.

6. Captain J. E. Stark presented the summary of the recent DASA Biomedical Research Coordination meetings, the last one being held at the Walter Reed Army Institute of Research. Captain Stark added that in addition to these meetings, there were numerous other coordination meetings among the service laboratories. These meetings have produced a marked increase in coordination of research efforts and have provided assurance that unnecessary duplication of research efforts has been avoided. The next meeting will be held at the Air Force Weapons Laboratory, Albuquerque, with dosimetry as the principal subject of discussion. It is felt that all of the efforts of the Coordination Meetings, the courses, meetings, etc., have culminated in a vastly improved level of communication between the services at the various laboratories and it is hoped that this will continue.

7. In his closing remarks, Admiral Mustin expressed his appreciation to the members of the Board for their support of the AFRRI, and stated his conviction that a joint service activity which has the full backing of each service constitutes the best means of assuring a research program responsive to service needs.

8. Next Board of Governors Meeting. A specific date for the next meeting will be determined later.

9. The Board adjourned at 1200 hours.

4 Incl
Presentations by AFRRI
Directorate (Draft)

J. E. STARK
Captain MC USN
Chief, Medical Directorate
Defense Atomic Support Agency

VADM L. M. Mustin, USN Director DASA
VADM R. B. Brown, The Surgeon General, USN
Lt. General K. E. Pletcher, The Surgeon General, USAF
Colonel William Dunnington, USA Director of Prof. Svcs, Office of the Surgeon General

Dr. John R. Totter USAEC
Dr. H. B. Bruner, USAEC

Colonel J. B. Young USA OTSG
CDR Charles F. Tedford, USN BUMED (CAPT Lloyd Miller USN BUMED) maybe
CAPT B. K. Hastings, USN BUMED

Colonel R. S. Malone, USAF, OTSG
Lt. Colonel Dale R. Lindall, USAF OTSG
Colonel Alvin F. Meyer, USAF OTSG (maybe)

CAPT C. L. Waite, MC, USN CO NMS NNMC

Major John J. McCambridge, USAF Deputy Chief of Staff, R&D (AFRDD)

DASA

Capt. J. E. Stark, USN
Mr. P. H. Haas
LCDR C. T. O'Neill USN
Lt.Colonel W. R. Godden, USAF
Colonel J. A. Hilchken, USA

All AFRRI Department Heads invited.

COLONEL L. E. BROWNING, MC,

Admiral Mustin, Gentlemen:

While gathering the material for this presentation I was impressed by the relative wealth of detail in the history of the institute that could be of interest to this group, at the same time I had to recognize that there was little justification for the parroting of inconsequential minutiae and less value in attempting such a detailed account that the salient facts were completely obscured. As a consequence, I propose to discuss those facts pertaining to the development and growth of AFRRI, from the initial stirrings of its origin to the present, that would appear have most relevance for the Board.

The Armed Forces Radiobiology Research Institute had its beginnings in a project proposal originated by the Chief, Bureau of Medicine and Surgery, USN on 13 August 1958. This paper recommended the establishment of a bio-nuclear reactor facility at the National Naval Medical Center. As originally conceived by the Surgeon General, the intent and purpose of the facility was that of extending and corroborating the results obtained from bio-medical field experiments and weapons tests.

This proposal received a favorable endorsement from the Chief of Naval

Operations and, some two weeks after it was originated, it was forwarded to the Armed Forces Special Weapons Project, now the Defense Atomic Support Agency, with a recommendation that this research facility be established at the National Naval Medical Center. The Office of the Surgeon General, U. S. Army, and the Surgeon General, USAF, indicated their interest and the Public Health Service, the Atomic Energy Commission, the Office of Civil Defense, and the Assistant Secretary of Defense, (Health and Medical), Dr. Frank Berry, concurred in the establishment of the facility.

In February 1959, the Chief of Naval Operations forwarded a letter to Rear Admiral Edward N. Parker, U.S.N., Chief, AFSWP, in which he stated that "since biomedical research is best obtained under controlled laboratory conditions, the earliest establishment of subject facility is considered vitally necessary. This will provide medical department personnel with the capability of fulfilling their mission in the area of biomedical research and training. The above concept is considered valid regardless of the future status of nuclear field testing."

In this letter it was pointed out that further action on the implementation of this proposal could not be taken until assurance of support was

provided by other interested government agencies. It was urged that the AFSWP sponsor the program and request special allocation of funds for facilities at the NNMC.

Some three months later, the Advisory Panel on Medical Sciences for the Director, Defense Research and Engineering, Dr. Herbert F. York, recommended that the project be approved. This recommendation was then forwarded, formally, in a memorandum for Dr. York. In October, Mr. John M. Sprague, the Deputy Assistant Secretary of Defense, in a memorandum for the Chief, DASA, forwarded the recommendation from DDR&E that DASA support the reactor facility. DASA then proceeded with the justification for, and the design of, a facility to fulfill the initially defined requirement.

When the research facility was proposed a cessation of atmospheric testing of nuclear weapons was imminent and the need for a substitute for this source of high energy radiation was obvious. However, the wording of the early correspondence concerning the facility is very explicit in pointing out that the facility should be built "regardless of the future status of nuclear field testing." The Institute evolved from the expression of

on atmospheric nuclear testing.

It was understood from the onset that DASA had an interest in the total biologic effects of radiation upon man, since if the man fails, the entire man-machine-weapon-system may fail. It was for this reason that DASA was concerned in sponsoring the construction of the reactor facility, recognizing the urgent necessity for the conduct of research into the total biologic effects of radiation, whether basic or applied, and whether directly or indirectly related to nuclear weapons effects.

During his tenure as Assistant Secretary of Defense, Dr. Frank Berry indicated in a memorandum that, while re-affirming his interest in the facility as related to DOD-wide application, he wished to assure that the facility would be made available as much as possible to other federal agencies. DASA fully concurred in this position, but emphasized that the prime purpose of the reactor facility was to conduct research in the biologic aspects of radiation injury related to nuclear weapons effects. Since the reactor possessed the near capability of simulating the spectrum from a

nuclear explosion it fulfilled an urgent military requirement, and it was upon this specific basis that funds were allocated for the construction of the reactor facility. Therefore, the Director, DASA had a DOD responsibility to assure the accomplishment of this objective.

The DASA position at that time was quite clear, that of a DOD sponsor, coordinator, and funding agent for a research reactor facility that would operate as a joint service military organization designed primarily to assist the Surgeons General in fulfilling their assigned missions in the event of nuclear conflict.

The next step in the establishment of this reactor facility was the selection of the appropriate radiation source. Feasibility studies conducted by the DASA staff resulted in the recommendation that the TRIGA reactor developed by the General Atomic Division of General Dynamics Corporation be purchased. The inherent safety of this reactor was the major factor in determining its selection for installation and operation in a heavily populated area such as Bethesda. The capability of this machine to produce pulsed radiation made it suitable for the type of research appropriate to the Institute.

However, after an analysis of the mixed radiation spectrum of the TRIGA was performed, it was apparent that there was a requirement for separate sources of neutrons and high energy bremsstrahlung radiation to permit more refined radiobiological studies. Therefore, an electron accelerator was added to the original plans as a second major radiation source for later acquisition. Thus, that early planning is just now coming to fruition some ten years later in the testing of the Linear Accelerator currently in the latter stages of its installation, the TRIGA having of course been in operaation for some six years since its licensing in 1962.

The long range facility development plan that has guided AFRRI's progress was initiated almost simultaneously with the assignment of the first temporary staff. This plan visualized phased construction and the acquisition of major components of equipment in a planned and sequenced fashion designed to cause the least interruption of current operating capabilities, the orderly budgeting of funds, phasing of major biomedical research efforts and the orderly acquisition of qualified personnel.

Following Congressional approval, construction of the first phase of

what was to become this substantial physical structure commenced in November 1960. The Armed Forces Radiobiology Research Institute officially came into existence in March 1961 when this title was approved and published. The next important date for AFRRI was 12 May 1961, when DOD Directive 5154.16, the AFRRI Charter, was published establishing the Institute as a joint agency of the three military departments, subject to the authority, direction, and control of the Secretary of Defense and under the management control of the Secretary of the Navy.

The principle of equal representation from all three services at the Directorate level was specifically spelled out in the AFRRI charter. The Secretary of the Navy, acting in consonance with this policy, confirmed the nomination, and formally approved the selection, of the first Directorate consisting of Colonel James T. Brennan, MC, USA, as Director, and Captain F. W. Chambers, MSC, USN and Lt. Colonel Carl L. Hansen, Jr., USAF, MC, as Deputies.

The task of formalizing the establishment of AFRRI was completed with the publication on 31 July of SECNAV Notice 5450 which vested command of the Institute in the Commanding Officer, NNMC, under the management

control of the Chief, Bureau of Medicine and Surgery.

The Phase I Laboratory and Reactor Building and the Animal Clinical Research Facility were not occupied completely until early fall, 1962. These structures gave AFRRI the nucleus of a research plant with the reactor and exposure room complex, some administrative space and laboratories and the small animal quarters. In any event it permitted the staff to take up permanent lodging within the embryo institute and evacuate their temporary quarters in the REEL building.

The organizational structure initially evolved for AFRRI was that of a series of task forces, each of which was assigned a specific mission, such as the development of the Hazards Analysis for the TRIGA reactor, training of reactor operators, and the like. In its first two years of existence, thru May of 1963, AFRRI developed and used three temporary internal organizational structures. Each was essentially an ad hoc type of structure improvised in order to pursue a few specific objectives.

The first permanent organization for staffing the Institute was developed and presented to the Board of Governors for approval in December 1963. This first formal organization established a total of eight departments in AFRRI

and set the pattern for the type of structure that has continued to the present. Four scientific departments were established, consisting of, Radiation Pathology, Radiation Biology, Analysis and Physical Sciences Departments. These were complemented by four support departments, the departments of Administration, Radiological Safety, Information and Education and the Program Coordination Office. By the time this organization was completed and approved AFRRI had a total of 105 personnel on board of whom 24 were officers, 21 enlisted men and 60 civilians. Military personnel were at authorized strength while civilian spaces filled represented 2/3 of the 90 personnel authorized.

Initially AFRRI was at least partially successful in retaining officers, obtaining trained replacements and developing a Linear Accelerator operating staff. More recently, the realities of current military operational requirements have worked against the maintenance of an optimum degree of stabilization and the rapid replacement of transferees.

Despite the instability of the AFRRI organization during these first few years, and the small number of personnel actually comprising the staff, it is surprising to note that some significant research projects were undertaken and carried thru to completion during this period. As early as the

first half of calendar year 1962 a small research team from AFRRI had participated in Operation BREN (Bare Reactor Experiment, Nevada) at the Nevada Test Site. This participation continued at intervals during the next 4 years through Operation BREN II and into Operation HENRE (High Energy Neutron Reaction Experiment). Participation in these field operations was for the purpose of providing data on the performance characteristics and operational capabilities of positive ion accelerators. The HENRE source was considered an excellent prototype for the High Intensity Fast Neutron Source under consideration at that time for installation at AFRRI.

Although the first biological experiment at AFRRI did not begin until 2 April 1963, and the Phase I laboratories were not fully operational until late summer of that year due to delayed installation of equipment, some initial work on performance decrement and incapacitation was carried thru to the stage where it was considered of such significance as to warrant reporting the data to the Joint Chiefs of Staff level. This report was submitted in January 1964. As a result of these findings the Joint Chiefs directed that this research be carried forward with all possible speed

addition to the initial four scientific departments. The impetus for the development of this department was another outgrowth of the JCS initiated research requirement for studies of the effects of massive doses of radiation on primate behavior.

Phase I construction had been completed and occupied and Phase II, including the add-on annex stimulated by the Joint Chiefs of Staff, was well on the way to completion. With these AFRRI would have a total of 67,000 square feet of space which had cost 4.4 million dollars. Funding had grown from an essentially insignificant figure in 1960 to a total research budget of 1.3 million dollars for fiscal year 64.

During this year AFRRI had scored another first of an unique sort. The year previously, AFRRI had irradiated a number of samples of material for the Internal Revenue Service to assist that agency in developing evidence in a case under investigation. Now in 1964, for the first time in the history of the U. S. Federal Courts, neutron activation analysis was accepted as legal evidence. The data on which this evidence was based was furnished the U.S. Treasury Department by the Physical Sciences Department of AFRRI.

and applied the principle of responsiveness to military requirements as a basic tenet of research philosophy. The first permanent organizational structure developed by AFRRI had provided a place for the "definition of military radiation problems and the application of radiobiological knowledge to their solution". In practice this principle was loosely translated to mean the establishment of criteria for AFRRI research priorities on the one hand, and the interpretation of operational requirements into scientifically meaningful terms for the investigator on the other.

The end of fiscal year 1964 also marked the end of the initial development and growth period of the institute. Although the authorized officer strength had been increased by 12 to a total of 36 billets, actual strength remained at 24 officers on board; enlisted personnel strength authorized remained at 21, with all spaces filled; civilian personnel authorized had been increased by 111 spaces to a total of 201 of which only 96 spaces were filled. This new civilian strength reflected an increase of 36 personnel recruited during the six month period from the first of the calendar year.

The Behavioral Sciences Department was established at this time as an

to determine and validate more detailed data concerning the studies. In order to comply with this directive it was obvious that additional space was required.

Following the completion of Phase I construction totalling 41,000 square feet of space, Phase II had been approved by Congress and construction of an additional 22,000 square feet of space had begun in October 1963. This consisted of additions to the Biomedical Research Building and the Animal Clinical Research Facility. In order to meet the JCS requirement a third story addition, consisting of 4,000 square feet, was proposed to the two story annex to the Animal Clinical Facility then under construction. AFRRI now had to approach Headquarters DASA with a request for construction funds.

Emergency Military Construction Funds were made available for this purpose and authority to proceed with the design of the addition was received just 3 months following submission of the incapacitation data to the JCS.

It was no accident that the first piece of significant research reported by AFRRI had immediate military applications. The Directorate had sponsored

addition to the initial four scientific departments. The impetus for the development of this department was another outgrowth of the JCS initiated research requirement for studies of the effects of massive doses of radiation on primate behavior.

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This type of analysis is now routinely admitted in court.

On 20 November 1964, AFRRI entered upon a new phase of its existence. With the publication of DOD Directive 5105.33 AFRRI was designated an operational field element of DASA. Just prior to this action command and administrative control over the AFRRI had been transferred from the Secretary of the Navy to the Director, DASA, Lt. General Donnelly. The Department of the Navy was to continue to provide logistic support but now in accordance with a host-tenant agreement between DASA and the Department of the Navy. With this change the status of the Board of Governors also underwent a change. As originally established by the AFRRI Charter, 4 years previously, the Board of Governors was responsible for the policy direction of the AFRRI on professional and related matters under DOD policies governing medical and allied activities. With the new Directive of 20 November 1964, the role of the Board became that of "assisting the Director, DASA, in matters of professional policy direction and related matters."

In March 1965 the Military Analysis Department was established giving added status to this function, a step designed to strengthen the military orientation of research and to further improve channels of communication

between the laboratory staff and the operational commander. Later that year all of the research oriented departments were assigned to one of the deputies while the five support departments, now including Military Analysis, became the responsibility of the remaining deputy, thus establishing the alignment of departments that has continued to the present.

The research budget had increased in consonance with the expansion of personnel and added facilities to a total of 1.97 million dollars for FY 65.

All of Phase II construction had been completed and occupied by mid-year, followed by ground breaking for Phase III in October. This 18,000 square foot addition was designed to house the positive ion accelerator and provide additional laboratory space and administrative offices. Because of the massive amounts of shielding materials required by the exposure rooms, this addition carried the substantial price tag of 1.2 million dollars.

The second half of FY 66 marked a continuing expansion and growth of AFRRI in terms of personnel, the acquisition of equipment, and the broadening of research efforts. Funding had grown to a total of 2.8 million dollars for that fiscal year, and civilian personnel strength totalled 146 against an

authorization of 197. Officer strength had increased to 37 with all authorized billets filled, while enlisted personnel remained at 21, the authorized strength.

As you are aware this date of 30 June 1966, marking the end of the fiscal year, has very special significance in terms of the personnel ceilings recently established for the CIVRED program. AFRRI had just emerged from its very traumatic growing pains and had begun to expand its personnel staff in consonance with increased facilities. In less than two years civilian strength had increased from 100 to almost 150 individuals. More rapid progress might well have been possible but was not indicated in terms of adhering to the principle of steady growth both in facilities and personnel. As a consequence the arbitrary establishment of the 30 June figure as the eventual goal of CIVRED must constitute a very severe setback to the AFRRI research program.

At that time the Joint Chiefs of Staff approved a change to the charter and organization of AFRRI providing for the establishment of a space for a Deputy Director, Scientific. This billet was subsequently filled by Dr. Wyckoff at the end of that fiscal year.

The JTD published on 1 July 1966 represented the last reorganization of the Institute that was essentially internally generated.

The three new JTDs developed since then have resulted from external pressures of fund cuts or the actions of manpower inspectors. At the beginning of fiscal year 67, however, the separation of the scientific and administrative departments was completed. The Director now had two deputies, the Deputy Director, Scientific, who, with the support of an Assistant Deputy Director, was responsible for the five research oriented elements, the Laboratory Support Office having been added to the scientific side of the house. The Deputy Director, Operations and Administration, retained the five support departments.

The advent of fiscal year 1967, heralded a new program of austerity on the part of the government. Despite the fact that the civilian personnel authorization was set at 194 spaces, as a result of the loss of 3 spaces to a productivity cut, it was obvious that AFRRI could not afford more than 171 people. In the event, this self imposed ceiling proved to be optimistic in that the total civilian spaces occupied did not exceed 161 during the first half of the fiscal year and never exceeded 164 at any time during the remainder of that period. Travel funds were cut, overtime payments had to be decreased by over 60% from the preceding year and purchases of capital equipment were deferred.

Eventually the budget was stabilized at 2.6 million for the fiscal year, down 200,000 dollars from the preceding year. This meant of course that civilian pay raises had to be absorbed within the approved budget without regard for the impact that this would have on the procurement of supplies, equipment, or the funding of other services incidental to the running of the Institute.

On the plus side of the ledger, AFRRI held its first "annual" research symposium in June, 1967. This two day session entitled "Postirradiation Recovery Kinetics" attracted over 200 scientists representing a number of foreign countries as well as our own. This symposium was held at the National Naval Medical Center auditorium due to lack of space here at AFRRI. This factor, and the unavailability of funds have precluded the repetition of this meeting.

Coincidental with the start of that fiscal year, 1968, AFRRI was visited by the Joint Chiefs of Staff Manpower Survey Team. In almost unheard of generosity the JTD was increased by 4 military billets and 8 civilian spaces for a net gain of 12 from the previously authorized strength. Over and above the personnel changes recommended by the team, it was felt

that increased emphasis should be placed on industrial safety, that the Program Coordination Office should be abolished and the fiscal functions of that office transferred to a new Resources Management Office. The establishment of a Logistics Department permitted the consolidation of procurement, facilities planning and engineering support into one office. The net result of these organizational changes was the gain of one support department. An interim JTD incorporating most of the recommended changes was published in November 1967, but it was not until the end of that fiscal year that the current JTD, under which we are now operating, was developed and approved.

In the construction area, Phase III was accepted and occupied one year ago this month, bringing the total space available to the institute to 85,000 square feet. The final stage of construction of laboratory and administrative areas commenced on 9 April 1968 with ground breaking for the 36,000 square foot, four story Phase IV building, now under construction. This addition will feature a large exposure room designed to house a half million curies of Cobalt 60. Initially a source strength of 50,000 curies is planned. A large conference room, some office space and a number of laboratories will be incorporated in this addition. Completion of this structure will permit us to dispose

of the trailers and return his parking lot to Admiral Canada. When Phase IV is accepted AFRRI will have invested a total of 10.0 million dollars in real property representing 121,000 square feet of space. When the cobalt handling equipment to be installed in Phase IV is operational, and equipment programmed for purchase by the end of the current fiscal year is obtained, the plant equipment account will total 2.0 million dollars.

A major administrative change took place at this time with the removal of the security classification of "Restricted Area" from AFRRI as a whole and any areas therein. Retention of the Restricted Area label with its inherent security requirements, guard force, and limited access to the facility, was determined to be unwarranted in terms of the AFRRI mission and the nature of the research program. A modest saving of funds was also effected by this move. The identification badge system was retained for the time being to permit of a degree of administrative control over non-AFRRI personnel visiting the Institute. This system will be closely scrutinized next April and will probably also fall by the wayside.

The budget for the past fiscal year was increased slightly to 2.7 million dollars. In the face of rising equipment costs, increases in utility rates, and recent and projected civilian salary escalation, rigid economy of operation was essential in order to avoid financial embarrassment. One of the results of the hiring freeze in effect towards the end of Fiscal Year 68 was a decrease in the staff to a total of 151 civilian personnel.

The current fiscal year began with another retreat in the personnel area. After increasing the AFRRI JTD by a total of 8 civilian spaces, the JCS rescinded the increase and extracted an additional 3 spaces as a productivity cut so we began the fiscal year with a new TD which reflected the new total of 178 civilian spaces authorized and an organizational structure that represented a final effort to incorporate the recommendation of the JCS Survey Team into the final product.

By coincidence these 11 spaces have just been returned to us and they will be made a part of the Joint Manpower Program for Fiscal Year 1970. To complete the personnel picture further mention must be made of CIVRED and its impact on AFRRI. It was noted earlier that the civilian on-board strength of AFRRI on 30 June 1966 was 146, the magic number that will at some un-

specified time in the future establish the strength of the Institute. Our hiring ceiling today stands at 156, therefore we stand to lose an additional 10 of our people if the CIVRED philosophy is carried through. (See handout).

We have been forced into some recent organizational changes as a consequence of the loss of key personnel and our inability to carry out a vigorous recruiting effort under the restraints of the CIVRED program. We have disestablished the Technical Information and Services Department and reallocated the majority of the functions of the department to other administrative elements of AFRRI. (Chart on) This chart reflects the JTD that we have recently submitted to Headquarters, DASA for consideration and approval. It is apparent that we have attempted to shift the emphasis even more heavily to the research side of the house. Some of the functions of the now defunct Technical Information and Services Department, such as the Library, and Graphics, were transferred to the Administration Department, but the Publications element, which is responsible for our final product, reports, was placed directly under the Deputy Director, Scientific. This JTD still stands at a total of 37 officers, 26 enlisted personnel, and 178 civilians authorized. Actual on-board strength is 33 officers, 4 below strength, and 25 enlisted personnel, with one more

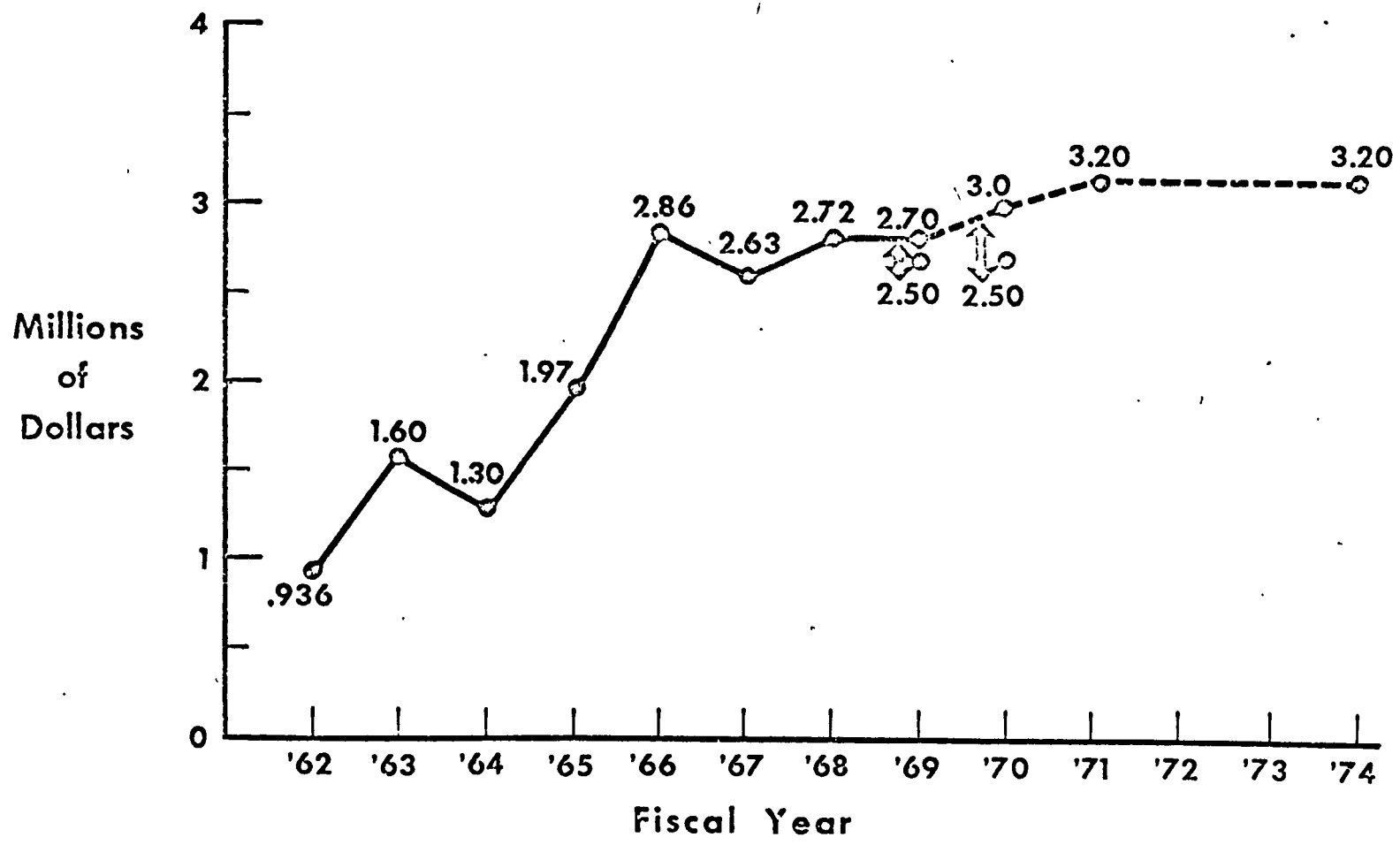
sergeant to report in a few days to bring us up to our authorization in the enlisted ranks. Our total civilian strength today is 153, leaving a total of 25 civilian spaces unoccupied.

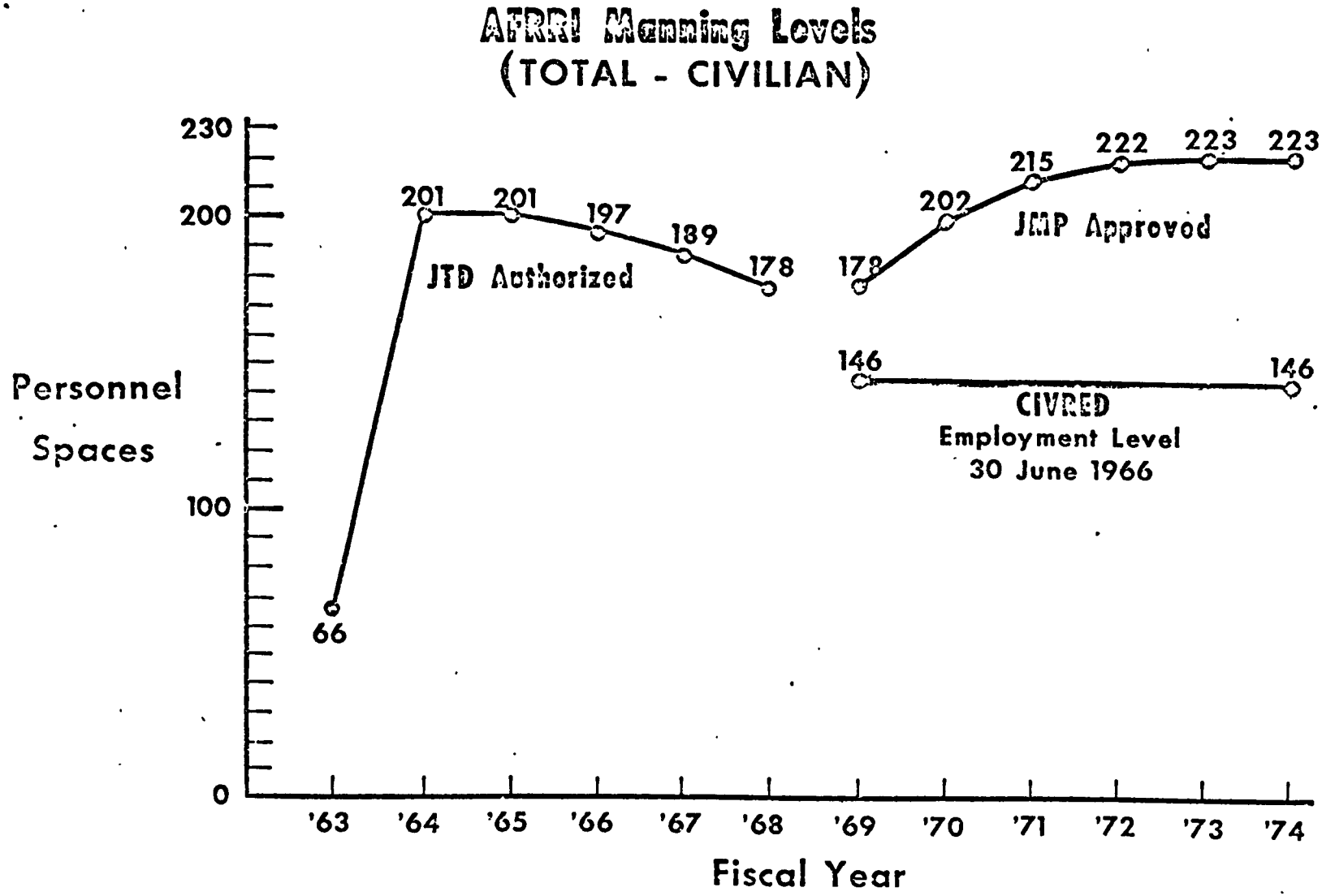
Our budget for this fiscal year has been set at 2.5 million dollars, down 200,000 dollars from the 2.7 million originally programmed. The handout furnished you shows our funding for the past 7 fiscal years and the five year projection. This projection and the Joint Manpower Program, which also extends over the next five years, are mutually consistent. What the future holds in this respect is unknown but we feel strongly that the increased budget and manpower authorizations are required to fully and efficiently utilize the plant capacity that will be available to us when the current construction program is completed.

Even with the current drop in personnel ceilings, making our pocketbook fit our requirements has been a character building exercise. The partial austerities of the past three years have been an excellent training ground but the results that we are able to accomplish during the remainder of this year and into the future will prove how well we have learned our lessons. If there are no questions I yield the podium to CDR Varon who will tell you what we

have accomplished as a result of our past efforts, and what we expect to achieve in research in the future.

AFRRI Funding Levels

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100
0
Personnel
Spaces
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201
201
197
189
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JTD Authorized
178
202
215
222
223
223
JMP Approved
146
146
CIVRED
Employment Level
30 June 1966
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'64
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'67
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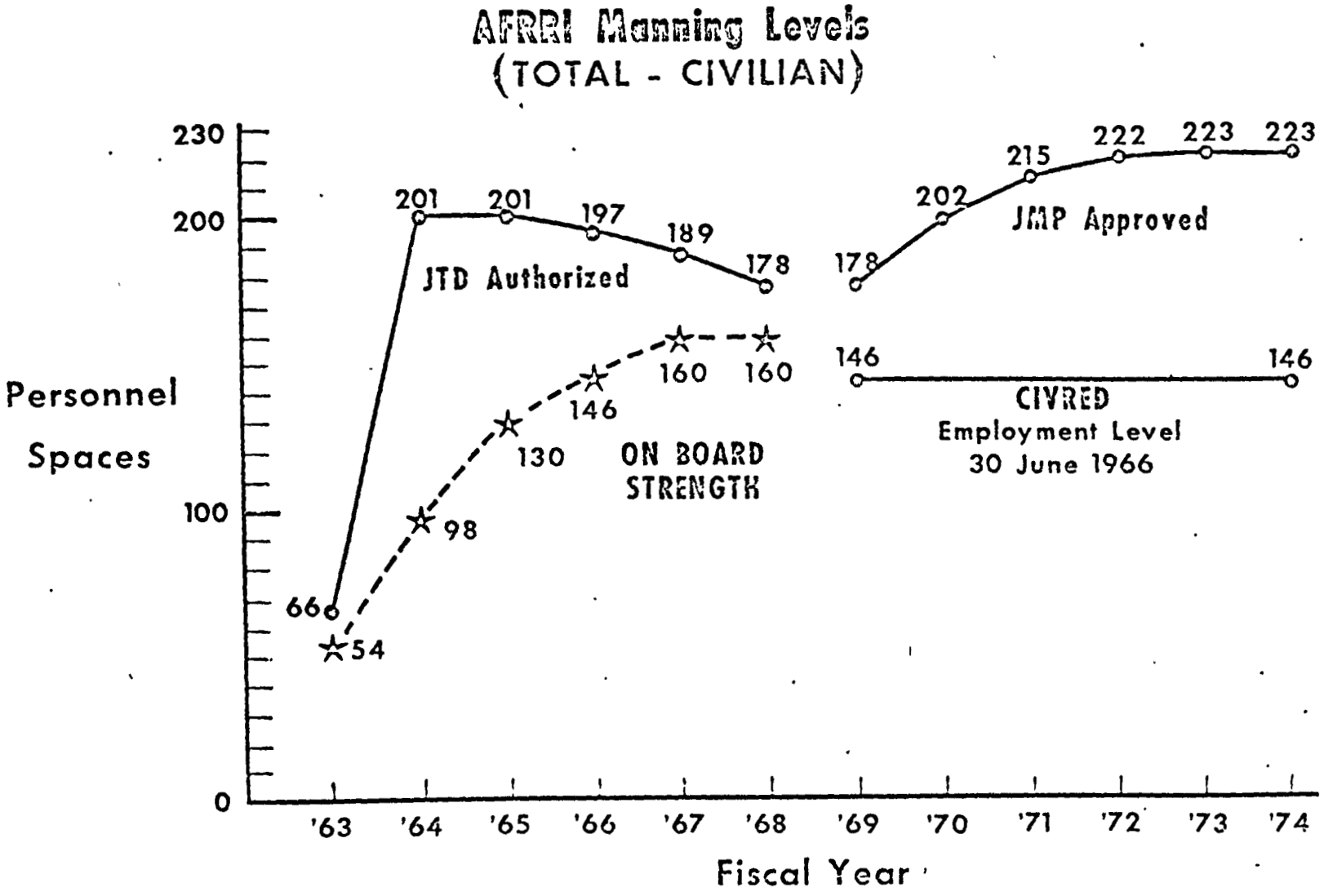
'71
'72
'73
'74
Fiscal Year


AFRRI Manning Levels
(TOTAL - CIVILIAN)
Personnel Spaces
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200
100
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201
201
197
189
178
JTD Authorized
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54
98
130
146
160
160
ON BOARD STRENGTH
178
202
215
222
223
223
JMP Approved
146
146
CIVRED
Employment Level
30 June 1966
'63
'64
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'72
'73
'74
Fiscal Year

PRESENTATION
18th MEETING OF THE BOARD OF GOVERNORS
Thursday, 5 December 1968

AFRRI Development and Progress Report

COLONEL MITCHELL:

Admiral Mustin, members of the board - even though this particular part of the program bears the title AFRRI Development and Progress Report, I prefer to think of it as a "state of the union" message. The basic purpose of the presentation is to familiarize you with the changes and progress made by the Armed Forces Radiobiology Research Institute in adjusting its total response to more optimally meet the requirements of its mission. In reality, at no prior board meeting has change or progress been described except in an occassional or piece-meal fashion. I offer that such a review is now needed. I feel this would be true for a board well into their membership tenure, and particularly pertinent in the present circumstance where there is a new chairman and a new member, and an additional member whose past association has been limited and interrupted. The objective in presenting to the board a state of the union message is to provide information - with appropriate background and chronology - that should be significantly helpful in your continuing assistance to and orientation, understanding, and support

of this facility.

The best place to begin is, obviously at the beginning, and to consider the question: "Why was AFRRI established?". Let me respond by citing that it was established to carry out important radiobiological research for, principally, the military departments. This basic reason or puspose was predicated on the facts that most biomedical research is more practically, successfully and economically carried out in a laboratory environment, and that creation of a central laboratory with joint ? tri-service pooling of support and staffing was the most logical, efficacious and frugal method of attaining the research objective identified. These factors were augmented by the ensuing point that cessation of atmospheric weapon testing demanded that biomedical research related to weapon effects be continued in the laboratory. On the basis of these principles AFRRI was conceptualized and then chartered in 1961, being given the mission "to perform scientific research in the field of radiobiology and related matters that are essential to the medical support of the United States military services, to national welfare and to the well being of mankind.

In summary, this stage of AFRRI development can be considered a crawl, and was characterized by a real beginning in research, generally uninterrupted by even the pressures and effects of sponsor changes, continuing construction, and some reorientation of the research endeavors. This stage also saw a complete turn-over in the leadership of the Institute with the staggered retirement of the original Director and Deputies and the inauguration of their replacements, as well as the incorporation of a civilian Deputy/Chief Scientist. Time and effort was required for orientation of the new leaders to assure the undisturbed continutation of activity and command. It involved the infusion, of course, of some new ideas and experience which began slowly to be considered in the course of the laboratory's operations.

The third period covers the span from 1966 to the present time, and has the theme: Production and Distribution of an End Product. Important aspects of this period include:

1st. Further and comprehensive refinement of research objectives to meet even more clearly identified military requirements.

2nd. Programmatic adjustments to meet the constraints associated with reduced biomedical funding and the CIVRED program.

3rd. Increased emphasis on reporting completed research.

4th. Near completion of construction of major facilities and sources.

I believe, within this period, that AFRRI began to make really its impact and to clearly exhibit its potential. The crawl has now become a walk. AFRRI has faced, successfully and stably I might add, the serious pressures of austerity in budget and personnel allowances. Regarding these austere factors, let me emphasize that although other governmental organizations have certainly encountered the same tribulations, the effect in AFRRI's case has occurred and been absorbed during a very sensitive period of growth and physical plant expansion.

With this introduction I would like to yield the podium to, first, Colonel Browning and then CDR Varon for a more detailed presentation on the principal actions and accomplishments to which I have more broadly alluded.

The scope of the research objectives in the early period of AFRRI's development was very limited. Indeed, the research conducted between 1962 and 1964 was generally not directed toward the solution of military radiobiology problems at all! Instead, the Institute's initial research cadre was asked to accomplish tasks essential to the establishment of the Institute's performance capability. Specifically, the research staff's effort was directed towards the preparation of a hazards report necessary to permit operation of the Institute's then principal radiation source--the AFRRI-TRIGA reactor; the design of follow-on research facilities; the development of organizational documents, standard operating procedures, the preparation of position descriptions necessary to recruit and expand the staff, and the development and conduct of special training programs required to familiarize the staff with the Institute's existent physical plant.

Although in this period AFRRI management was primarily interested in the development of a performance capability, a limited amount of radiobiological research was undertaken. Like the administrative and support tasks enumerated above, most initial AFRRI research was related to acquiring baseline information and did not relate directly to military radiobiology requirements. Typical of the types of research and research-oriented projects conducted by AFRRI during this period were:

a. The determination of baseline lethality and dose-response characteristics associated with a pulsed and steady-state gamma-neutron radiation source.

b. The determination of dose-dependent biological response syndromes related to exposures to x- and gamma-radiation.

c. Examination of the AFRRI-TRIGA neutron energy spectrum.

d. Development and fabrication of radiation detectors capable of measuring pulsed delivered doses of thousands of rads.

e. The study of reactor-produced radiation transport and energy deposition phenomena.

The few mission-oriented research projects initiated during this period were proposed and conducted by investigators whose expertise and experience in military oriented radiobiology was very limited. However, this did not pose a particularly significant problem in that the lack of definitive information related to the effects of ionizing radiation on biological systems was, at that time, so great that almost any project could be justified as being applicable to the needs of the military. Reflecting the lack of specific boundary conditions, the management actions by AFRRI and higher authority related to the Institute's early research proposals were limited, almost exclusively, to simply approving or disapproving proposed research. This was in contrast to evaluating program proposals in light of specific guidance obtained from the military or provided by local management. As will be seen, the evolution of the AFRRI research program from the formulation of very general research goals and proposals to the present condition, in which well defined work units applicable to specific military research requirements exist, has been a continuing process and indeed may well characterize the joint service nature of this Institute.

When AFRRI's management began looking beyond establishing the Institute's performance capability, it became clear that research by "simple approval" had to change. It did! The AFRRI research staff's effort was reoriented toward the performance of research projects directly related to the Institute's primary mission. Specific departmental approaches to military-oriented radiobiology research were defined. Explicit research objectives were established. An organizational framework similar to that seen at AFRRI today was developed and implemented.

Although there were, and continue to be today, many cross-over lines in terms of cooperative and collaborative efforts between departments, areas of technical expertise and the methodology of various scientific disciplines were grouped within separate departments with broad areas of responsibility. Responsibility for physical studies, dosimetry, radiochemistry, mathematical analytical techniques, and operation of AFRRI radiation sources was assigned to the Physical Sciences Department.

The Institute's Experimental Pathology Department was assigned the function of studying subcellular responses to radiation, cellular injury and recovery systems, and the effects of radiation on immune systems and susceptibility to infection.

Acute organ and system responses, whole-animal lethality studies, drug responsiveness and incapacitation studies utilizing untrained animals were undertaken by the AFRRI Radiation Biology Department.

Responsibility for studying behavioral responses employing primates trained in specific tasks both in the restrained and unrestrained state was assigned the Behavioral Sciences Department.

During the period of 1964-1966 when the investigative staff at AFRRI became more totally involved in the conduct of research, the AFRRI management sought to further orient the Institute's research program to meet better defined military research requirements. As a first step, the Military Analysis Department surveyed individual service requirements to determine what specific research problems most closely related to AFRRI's then current performance capability. (Slide 1) The service requirements for radiobiology research with associated service priority indications are listed in the appropriate columns. On the right are the AFRRI research elements which were consistent with those service requirements. As a consequence of this survey, the nature of AFRRI's research program began to change from a program characterized by many different projects utilizing a wide spectrum of radiation doses to one with fewer, more specific projects involving high doses and acute radiation responses.

Concomitant with the analysis of service requirements performed by the Military Analysis Department, Colonel Mitchell, then DASA Surgeon and Chief of the Medical Directorate, organized the AFRRI research work effort into well-defined subtasks. These subtasks formed the organizational and functional groupings of AFRRI's approved research work units. The subtasks, which I shall describe briefly, exist in the same context today, although the number, level of effort and emphasis of the work units within the subtasks have changed.

Subsequent to the explanation by the DASA Medical Directorate of the NWER priorities which were established at the direction of Dr. Wikner, and discussed by Captain Stark at the last Board of Governors meeting (Slide 2) which I list in this slide--AFRRI management undertook a programmatic review of its research program to place increased emphasis on higher priority radiobiology research. This reallocation of effort took place within the frame work of the nine AFRRI Research Subtasks which I would like to describe briefly, to illustrate some of the things we are doing--and why.

(Slide 3) R MD 3 900 The Clinical Response of the Total Animal to Acute Radiation Injury. The first subtask deals with the study of the clinical response of the whole organism to ionizing radiations. A variety of animal species are used, with consideration of variable body size, metabolism and physiology to accumulate sufficient data for extrapolation to man's probable clinical response. Specifically, this subtask seeks to evaluate the increased probability of survival for animals irradiated in the lethal range and subsequently provided with symptomatic and prophylactic treatment of the types routinely used in medical management of radiation accident cases. Also under study in this subtask are preirradiation physical conditioning and postirradiation exercise regimens directly related to the actions of military personnel in a radiation environment situation.

R MD 3 901 The Biochemical Study of Acute Radiation Injury. The second subtask is directed to the identification of the complex biochemical changes which occur following acute radiation injury. Biochemical changes and their sequela are the earliest and perhaps the most important

disturbances responsible for ultimate clinical responses. Investigation into the biochemical systems and sequence changes involved, the alterations occurring, the disturbances created, and the effect on morphology and function are a part of this subtask. Information obtained from this subtask will contribute to a better understanding of damage mechanisms, and of diagnosis, prognosis and therapy in the animal species used, and is necessary to permit maximal interpolation of the data to man himself.

Included in this subtask is research directed toward the identification of specific protein changes in the serum of animals to predict their individual radiosensitivity, and to establish prognosis criteria for the treatment of irradiation casualties. One of the work units has led to the development of a technique of analyzing carbohydrate containing proteins and has enabled the investigator to predict, of a group of animals irradiated in the midlethal range, which animals will survive and which animals will succumb to the irradiation. The specific biochemical mechanisms involved in the determination of this prognosis of individual radiosensitivity are clearly a significant approach to the determination of which exposed personnel are more likely to succumb to a given dose of ionizing radiation.

R MD 3 902 The Cellular and Subcellular Level Study of Acute Radiation Injury. The third subtask investigates the effects of radiations on more complex biological materials, intracellular elements. Although initial energy deposition from ionizing radiation is absorbed at the molecular level, the expression of injury is often seen at the cellular level by reproduction abnormalities and functional alterations in cellular metabolism. It is essential to study the cellular aspects separately, as

well as investigating alterations following ionizing radiation as seen at the subcellular level. This subtask involves investigations and evaluation of the cell and cellular component changes arising from injury following irradiation of different types, qualities, dose rates, and total dose. Knowledge of the dynamic chain of events following absorption of ionizing radiation is pertinent to a better definition of damage mechanisms, and to improvement in interpretations of response, recovery, prophylaxis and therapy. Studies in this work unit include the determination of post-irradiation changes in biochemical composition of membranes isolated from mammalian intracellular organelles. Also included in this subtask is a collaborative work unit with the Catholic University of America on the effect of ionizing radiation on nucleolar ultra-structure and ribosome formation in mammalian cells.

(Slide 4) R MD 3 903 The Organ and System Response to Acute Radiation Injury. The subtask at the top of this slide approaches radiation effects at a higher organizational level--from molecules to cellular elements to multicellular organ systems. Generally the most obvious gross clinical changes following acute radiation injury in the mammal are due to a disturbance in function or pathological aberration in an organ system. The classical bone marrow depression, gastrointestinal and central nervous system syndromes are general expressions of radiation response, but there is much detailed information relative to organ-system responses which remain to be defined. Using a variety of animal species and radiations, this subtask pursues a systematic investigation of organ-system responses.

Included are studies specifically designed to evaluate the efficiency of standard immunological procedures which the medical departments of the Armed Forces have developed over the years for military personnel. At the present time, a study of the protection afforded against tetanus by present innoculation procedures is being undertaken in irradiated animals which are then subjected to the administration of tetanus toxin. Concomitant with this study is another on the basic factors underlying any alterations in susceptibility to tetanus microorganisms and toxins subsequent to ionizing radiation. Research results from this work unit is directly applicable to the effectiveness of the immunization program of the military services in an environment where members of the Armed Forces are subjected to ionizing radiation. Specifically, this research should shed light on the question of whether the radiation dose received by an individual will neutralize the effects of all or part of the immunization shots he has been given.

Another work unit in this subtask concerns the investigation of radiation-induced gastrointestinal damage. Since it is possible that many military personnel may be exposed to ionizing nuclear radiations in the dose range where gastrointestinal damage may be significant, results of this research would be of importance to the military medical services for the determination of therapeutic regimes for such exposed personnel, particularly where performance of such exposed personnel will have relationship to the following subtask. Other research in this subtask is designed to determine the effects of radiation on the stem cells of the blood-forming system and to provide the

basis for giving the military medical services a set of guidelines for estimating casualties from exposure to lower level doses of ionizing radiation in personnel which may be at risk for subsequent irradiations.

R MD 1 904 The Behavioral Decrement and Incapacitation Response to Acute Radiation Injury. The next subtask has the highest priority of any performed at AFRRI. Animal experimentation suggests that even with very high doses of ionizing radiation, there may be periods following irradiation where work functions may successfully be carried out. It is of great operational importance that reliable estimates of man's performance capability following injury from ionizing radiation be estimated with reasonable accuracy. More precise information is needed to better define immediate, transient, and delayed incapacitation, the amount and duration of performance capability, and the relation of these parameters to total dose, dose rate, radiation type and quality and exposure geometry. Inherent and essential to this type of study is the simultaneous development of associated tests, techniques, and equipment. Since the degree of performance decrement for a given dose may be dependent on task complexity, testing schemes of various difficulty must be employed and assayed. Also essential is the use of appropriate species from which meaningful data can be obtained.

One of the most formidable problems in the study of behavioral decrement following high doses of ionizing radiation is the extrapolation of behavioral data from animals to man. Of the three classical clinical syndromes following high doses of radiation, the bone marrow, gastrointestinal and central nervous system syndromes, there is much more known about the first two than the central nervous system syndrome. This is so not only because more work

has been done at doses where the hematological and gastrointestinal syndromes are manifest, but also because the experimental results obtained in hematological and gastrointestinal lethality studies are much more consistent from species to species and are easier to interpret. There are certainly differences in the susceptibility of bone marrow and G.I. injury between species, but these are not differences of an order of magnitude and the clinical picture shows basically the same physiological and pathological responses in all species. There are less parallels between species, however, when one compares response of acute central nervous sytem manifestations at higher doses--and it may be worthwhile to point out--that in addition to differences between species there are differences in behavioral and also lethality responses between the same groups of animals under restrained or unrestrained circumstances, which are evidently quite significant.

R MD 1 905 The Physiological correlates of Acute Radiation Injury. The bottom subtask is essentially vacant. Commencing 1 January 1969, there will be no work units in this subtask. The AFRRI review initiated by Colonel Mitchell resulted in the deletion of the existing work units in this subtask due to the long range character of these studies which do not lend themselves to short time-frame answers to operational military radiobiology requirements.

(Slide 5) R MD 3 906 Clinical Evaluation and Therapy of Acute Radiation Injury. The subtask at the top of this slide is directed at therapy of radiation injury. Currently the basic treatment of radiation injury is symptomatic. The agents and techniques used and proposed in therapy are those commonly used in clinical medicine to treat similar symptoms arising

from other causes. This has been the case because the ultimate damage, signs and symptoms of radiation injury are nonspecific in nature. This subtask originally dealt with the effects of radiation on the metabolism and action of various therapeutic agents which might be used in the treatment of radiation injury. The scope of this work has been changed following the AFRRI review to make it more applicable to the study of vasopressor drugs in the attempt to modify or eliminate the period of early transient incapacitation following high doses of irradiation which may be related to the cardiovascular collapse seen after such high radiation doses.

R MD 4 907 The Biophysical Aspects of Acute Radiation Injury. The next subtask utilizes the technology of physical chemistry, radiation chemistry, and electronics. The sequence of events taking place between the initial absorption of energy at the molecular level following ionizing radiation & the biological expression of radiation injury are poorly understood. Using pulsed radiolysis methodology possible only with the unique characteristics of the AFRRI LINEAR Accelerator, fundamental research should lead to elucidation of the sequence of events which occur following the original absorption of energy. Within the subtask are also studies directed toward the development of special techniques using activation analysis and tracer methodology. Also included in this subtask is development of a radiation-hardened biotelemetry system so that physiological parameter information may be taken from animals in the unrestrained state to help us identify the physiological mechanisms which produce behavioral decrements in trained irradiated animals.

R MD 4 903 Operational Physics Contributions to AFRRI Radiobiological Research. The final subtask consists of development designed to modify, improve and create reproducible radiation source fields for routine and specialized radiobiological investigations. It is primarily state-of-the-art development necessary to maintain inhouse capability to provide practical and theoretical, mathematical and statistical interpretations of biomedical experimentation results, and to rapidly accumulate, convert, analyze, and store data from real-time ongoing radiobiology research.

The preceding nine subtasks are monitored by DASA Project Officers, who confer with principal investigators at the bench to exchange ideas in both technical and operational areas.

The DASA Medical Directorate has also placed increased emphasis on cross-laboratory coordination. Such coordination is being accomplished by the DASA Medical Long Range Planning Meetings to which the services provide input; semi-annual DASA Coordination Meetings which review various laboratory programs, objectives and current state-of-the-art results and specific coordination meetings on specific requirements such as the recent meeting on incapacitation and performance decrement. At this meeting operational planners presented their requirements for discussion and evaluation, together with bench-working investigators.

Reflecting the changing nature of the AFRRI research program, i.e., involvement in high-dose acute radiation research, the priorities established by higher authority and the availability of more definitive

military research requirements, AFRRI undertook a general programmatic review of its entire research and support effort. Specific objectives of this review have been to:

1. Shift AFRRI personnel, dollar and facilities resources from long range projects to those providing more immediate answers. This has resulted in a decrease in total work units. (Slide 6) This slide shows the climb in number of AFRRI's work units when many research proposals were generated from below--approved in a time period when the philosophy was more permissive as long as it was radiobiology. Some of the work units at that time had poorly defined, imprecise objectives, or objectives that had limited relevance to military radiobiology problems. The concentration and consolidation of AFRRI resources into fewer, but specifically mission-oriented and expanded work units, is designed to provide the military services with increased information per research dollar expended.

The second objective of our programmatic review

2. Prepare preliminary research work unit proposals before hiring principal investigators instead of depending upon those uninitiated in the field of military radiobiology research to propose projects of interest to the services.

3. Establish a short time-frame response capability. The Head-shielding studies, to be presented in part today, arose out of discussions with Colonel Godden of the DASA Medical Directorate approximately 9 months ago.

4. Insure that longer range projects are assigned short range objectives and milestones to permit continuous monitoring of project progress.

5. Change the character and approach of existing research work unit proposals to answer specific mission-oriented questions. A specific example is the change in approach of the drug-responsiveness work unit, previously mentioned.

6. Establish a publications review procedure that insures the timely reporting of AFRRI research results. (Slide 7)

For an established laboratory the major end products from the expenditure of resources are published reports. Reports were not the result of AFRRI's major efforts in its early years.

The research which was performed by the original AFRRI research cadre was done part-time by a staff primarily working to establish a performance capability. Some of the accumulated experimental data had not been analyzed or reported until AFRRI's management made a special effort to get out the backlog. That special effort is reflected in the central hump on this slide. One of the significant reports which appeared at this time was the primate incapacitation study in pulsed-irradiated animals by Seigneur and Brennan, where the phenomenon of early transient incapaciation followed by a period of relatively normal responses was observed.

The problem of timely dissemination of research results was one which AFRRI management recognized was of extreme importance. A review procedure

was instituted with time periods established for each step in the review. A guide for authors of technical publications was developed to assist in the preparation of reports. The preparation of military application supplements was initiated to make AFRRI reports more meaningful to military operations personnel. A workable review procedure, the publication of an AFRRI Author's Guide, the placing of the Publications Office under the Scientific Deputy are all designed to shorten the time interval between the completion of an experiment and the publication of its results.

The year 1968 marks the conversion of AFRRI from promise to production. In addition to the number distributed in 1968, there are, as of last month, 43 AFRRI numbered publications in the review system, at DASA for clearance, or at the printer. There are 27 reports awaiting scientific journal publication or being submitted for publication. The quality of these publications is, at minimum, on a par with any established laboratory in the field.

In addition to its publication output, AFRRI has made significant contributions to the research efforts of other institutions in the military and civilian scientific communities, without degrading our primary mission.

The Atomic Energy Commission has used AFRRI's reactor operations, training and safety procedures as a showcase for demonstration to other reactor facility users. AFRRI has provided short-lived radionuclides such as fluorine-18 for the study of bone tumors and metastases in humans to the Naval Hospital and to the National Cancer Institute. We have

provided neutron activation analysis support to the Internal Revenue Service, the Postal Service, the National Institute of Dental Research, and the Naval Medical Research Institute. We have established collaborative efforts with the Viral Etiology Group of the National Cancer Institute, the Catholic University of America, American University, George Washington University, and the University of Pennsylvania. AFRRI has provided technical consultation and irradiation facilities to the Tissue Bank of the Naval Medical Research Institute in the study of using intermediate animal hosts for the preservation of organ grafts. We have provided other irradiation services to the Army Electronics Laboratory, to the Walter Reed Army Institute of Research, and the U. S. Naval Dental School.

This fall AFRRI was invited to participate in the Triton Scholar Program of the U. S. Naval Academy. We have on board, working in the Physical Sciences Department, one of the schclastically outstanding Midshipmen in his senior year, pursuing independent research.

I have attempted to review in the previous 30-odd minutes, the history of AFRRI's research program development--from the early establishment of a performance capability to the generation of research projects and products responsive to the needs of the military services. The review of the research program is a continuing action, and as the services present new problems in military radiobiology, AFRRI will continue to develop research solutions to these problems.

COLONEL MITCHELL:

Admittedly these past 60-ish minutes have been pregnant with description, but it certainly has not been my intent to bore or overwhelm you by this length and volume. Instead, I feel this amount of presentation has been indicated and is pertinent to the objective of providing information for the board's currency in understanding and orientation. I further feel, in this regard, that the time and material balance the scales to this value.

With regard to my earlier remarks and those ensuing, I think, in the overall picture, one can view these admittedly arbitrary stages of AFRRI history as, first, the birth, then a crawl, and now a walk.

Cardinal to all stages, but perhaps more strongly in the current one, has been the efforts to:

1. As rigidly as possible refine the research objectives.

2. Optimally and correctly stabilize the staff.

3. Effectively exploit the resources.

4. Develop and execute the most satisfying research program.

5. Overall, give the best possible product for the dollar and yet operate and comply with government-wide money and personnel restraints.

As a result of these efforts, appropriate changes have been devised and promulgated, both in organization, billet allocations, policy, and in the scope and orientation of the research projects themselves. From this continuing effort, I am satisfied that the Institute has made great strides in:

1. Optimizing the organization and personnel structure.

2. Exploiting the available and projected resources.

3. Concise definition and employment of objectives, coordination and orientation of the lab.

4. Maximizing the quality and quantity of research product, together with pointing of the research program itself to more acutely satisfy mission requirements.

5. Stable adjustment to changing philosophical and economic environments.

6 And, generally, becoming of age and statue for the investment that has been made.

Over this history, which has been highlighted more than described in exacting detail, I, along with all current and past staff members, can be proud of the organization's progress and accomplishment. It is quite clear that significant inroads and important contributions have been made and I would not hesitate to judge that, under the circumstances of its development and growth, AFRRI

has advanced and exhibited its capability and potential sooner and more profoundly than was originally anticipated. I further believe this has been done in the face of unusual (and unexpected) problems and constraints.

Over-viewing, as Director, the current status of the Institute, and well recognizing the past and present performance and potential, I am completely confident that the fourth stage of development will be a run - a lengthy and indefinite period where there will be a gradually increasing and sustained activity, providing a product rich in quality and appropriate in quantity for the requirements and the programmed support.

I hope, with this presentation, that we have achieved the objective of providing information, and I trust we have made the board sufficiently cognizant of the significant changes and progress, as well as the associated whys and wherefores.

If there are any questions we will be pleased to provide the answers.

Thank you.